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Fig.1

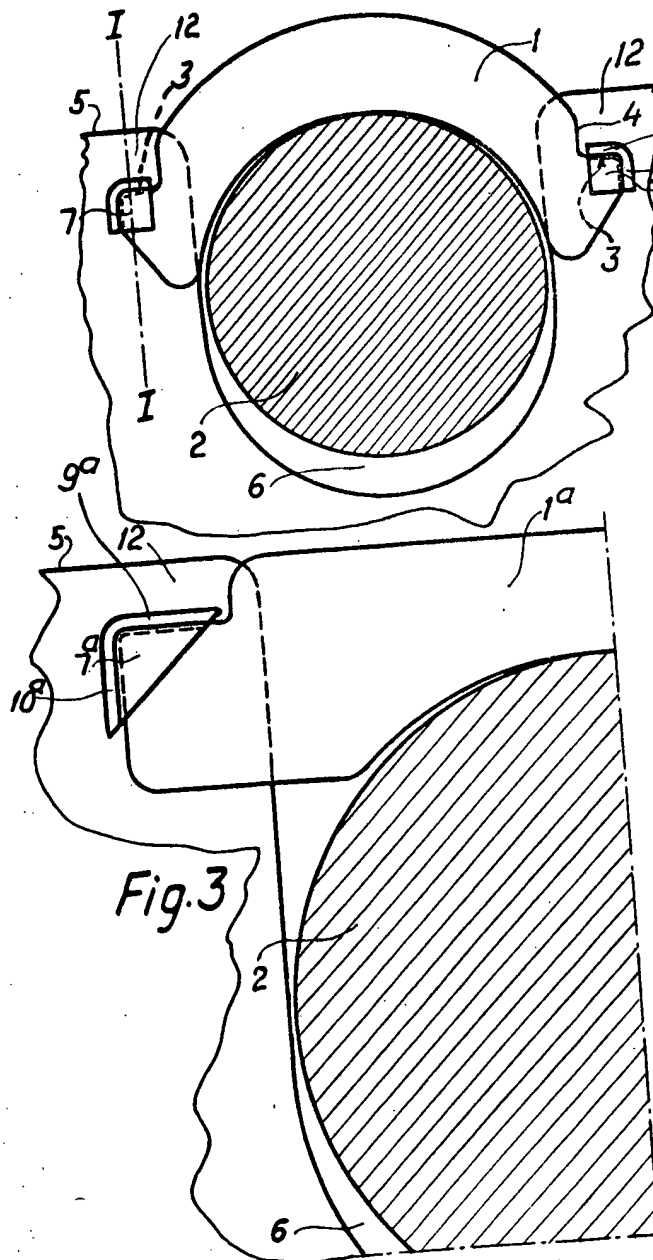


Fig.2

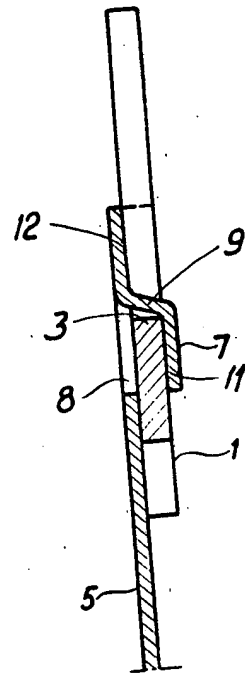
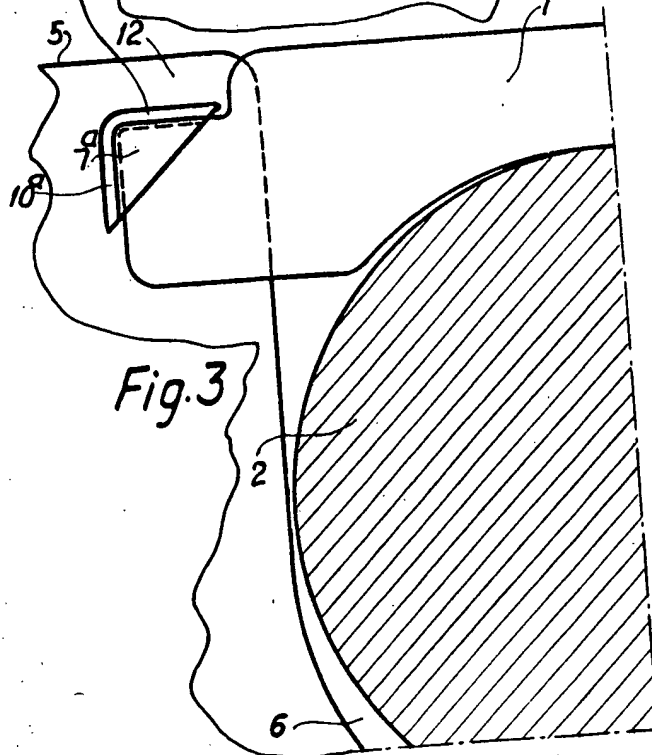
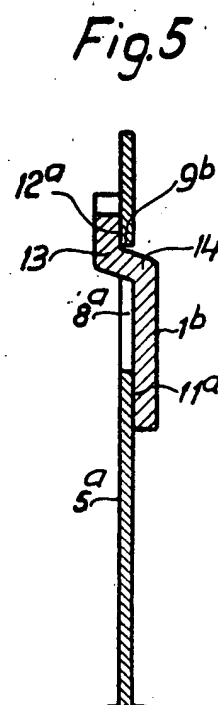
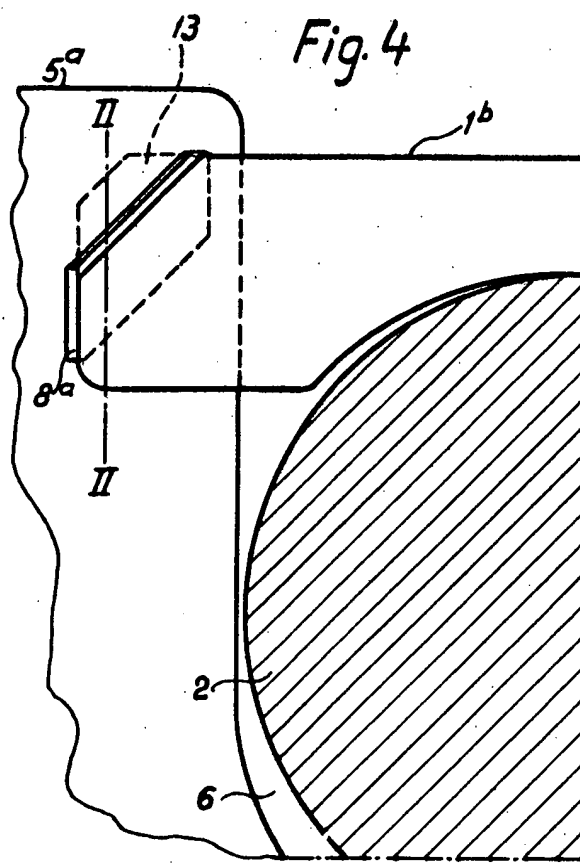


Fig.3



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Canadian Patent Office

622,045

Issued June 13, 1961

CANADA
DIN 32

Patent No. 622,045

Device for Suspending Plates in Heat Exchanger

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Application March 13, 1958, Serial No. 747,400
In Sweden March 18, 1957
7 Claims

This invention relates to plate heat exchangers of the type in which the heat exchange plates are suspended on a horizontal bar, each plate having in its upper edge an upwardly opening U-shaped recess for receiving the carrying bar, each plate at opposite sides of the recess being detachably mounted on the opposite ends, respectively, of a loose bow for suspending the plate on the carrying bar.

In heat exchangers of this type, the bows support the plates so that they can be readily pushed to and fro along the carrying bar, since the recess in the upper part of each plate for guiding it on the carrying bar is bridged over by this bow or cross-piece, the central part of which rests on the carrying bar. To enable removal of each plate independently of the other plates, as for cleaning, inspection, or regumming of sealing ribs provided along the outer edges of each plate, these bows must be readily detachable from the plates, as only after this has been done are the plates free from the carrying bar so that they can be removed from the heat exchanger.

For attaching the bows to the plates, various means have been used heretofore. Screws, for example, have been used in order to secure the ends of the bows to the plates, but this expedient requires considerable time and effort to loosen and then secure the screws again, which is particularly objectionable in those cases where it is necessary to remove the plates frequently from the heat exchanger. Also button-like pins attached to the upper parts of the plates have been used to suspend the plates on bows provided with corresponding holes; and in some cases the two downwardly directed ends of a bow are formed into bent-over hooks engageable in corresponding holes in the upper parts of the plates. Both of these expedients, however, have the drawback that the bow is attached too loosely to the plate so that the latter is vibrated in an objectionable manner when the plate is displaced along the carrying bar. It has also been found troublesome to clean the bent hooks and the button-shaped pins.

The present invention has for its principal object the provision of an improved arrangement for detachably securing the bow to the plate, whereby the bow is firmly attached to the plate so as to prevent vibrations when the plate is displaced along the carrying bar, and the parts, at least when disassembled, are easily cleaned.

According to the invention the plate part has two holes at opposite sides of the recess which receives the carrying bar, and the plate part also has bearing surfaces located adjacent the upper edges of the respective holes. These bearing surfaces rest on the respective end portions of the bow part which, in turn, rests intermediate its ends on the carrying bar. One of the plate and bow parts has a pair of stabilizing surfaces extending upwardly and downwardly, respectively, from each of the bearing surfaces. The stabilizing surfaces of each pair lie in

generally parallel planes which are displaced from each other in a direction normal to the plane of the plate part. Also, each pair of stabilizing surfaces on one of the plate and bow parts engage the other part at its opposite sides, respectively. Thus, the bearing surfaces adjacent the upper edges of the plate holes serve to support the plate part in suspended position on the opposite end portions of the bow part, while the two pairs of offset stabilizing surfaces on one of these parts, through their engagement with opposite sides of the other part, serve to hold the plate part tightly against the bow part and thereby prevent any looseness which could result in the aforementioned vibration.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which

Fig. 1 is a front elevational view of one form of the new arrangement for detachably mounting a heat exchange plate part on the end portions of the bow part, the stabilizing surfaces in this case being on the plate part of which only the upper central portion is illustrated, the carrying bar being shown in cross-section;

Fig. 2 is a sectional view on the line I-I in

Fig. 1;

Fig. 3 is a view similar to Fig. 1 but in half section and illustrating a modified form of the invention;

Fig. 4 is a view similar to Fig. 3 but illustrating still another form of the invention wherein the stabilizing surfaces are on the bow part, and

Fig. 5 is a sectional view on the line II-II in Fig. 4.

Referring to Figs. 1 and 2, the reference numeral 1 designates a flat bow part having its main portion shaped as a segment of a circle. The lower concave surface of the bow part rests upon the horizontal carrying bar 2 of the heat exchanger, the radius of curvature of this bar being somewhat shorter than that of the bow part 1. At each of its opposite end portions, the bow part 1 has a horizontal guide surface 3 and a vertical guide surface 4. A heat exchange part 5 is provided in the central portion of its upper edge with an upwardly opening, generally U-shaped recess 6 for receiving the carrying bar 2.

At opposite sides of the recess 6, the plate part 5 has portions 7 which are displaced from the plane of the plate part but are parallel to this plane. Each displaced part 7 is of quadrangular shape and is pressed and punched from the metal constituting the main body of the plate part, so as to form a hole 8 through this part. As shown, each displaced portion 7 has its horizontal upper edge joined to the main body of the plate part 5 by a portion 9 forming a bearing surface. This bearing surface is located adjacent the upper edge of the respective hole 8 and rests upon the horizontal guide surface 3 on the adjacent end portion of the bow part 1. At its vertical side edge which is remote from the plate recess 6, each displaced portion 7 is joined to the main body of plate part 5 by a portion 10 forming a stop which is engageable with the corresponding end of the bow part 1. Thus, each displaced portion 7 forms with the main body of the plate part 5 a slot which opens downwardly and toward the plate recess 6. Consequently, the opposite end portions of the bow part 1 can be introduced through these slots from below so that the bearing surfaces of the portions 9 rest upon the horizontal guide surfaces 3 of the bow part. In this way, the plate part 5 is supported on the bow part 1

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and can be readily detached therefrom by lifting the plate part relative to the bow part.

It will be apparent that at each side of the plate recess 6, the plate part 5 has a stabilizing surface 11 formed by the displaced portion 7 and extending downwardly from the adjacent bearing surface formed by the horizontal connection portion 9, the plate part also having a stabilizing surface 12 extending upwardly from this bearing surface 9. Also, the stabilizing surfaces 11-12 of each pair lie in generally parallel planes which are displaced from each other in a direction normal to the plane of the plate part 5, and these stabilizing surfaces 11-12 engage the bow part 1 at opposite sides thereof, respectively. Thus, the plate part is rigidly mounted on the bow part, the stabilizing surfaces 11-12 preventing relative movement of the parts about the bearing surfaces 9, and the stops 10 preventing lateral edgewise movement of the plate part relative to the bow part.

In the embodiment illustrated in Fig. 3, each displaced portion 7_a of the plate part 5 is triangular in shape rather than quadrangular as in Figs. 1 and 2, the main body of the plate being joined to this triangular displaced portion along its upper horizontal edge by a bearing portion 9_a and along its vertical edge remote from recess 6 by a stop portion 10_a, as in the Fig. 1 embodiment. The bow part 1_a in Fig. 3 is substantially straight instead of being shaped as a segment of a circle, although the lower edge of this part intermediate its ends is arc-shaped where it rests upon the carrying bar 2. In this way, the suspension point of the bow part 1_a on the carrying bar 2 is somewhat lower in relation to the bearing surfaces 9_a than in the case of the embodiment of Figs. 1-2, so that the suspension point on the carrying bar is approximately at the same level as the suspension points 9_a of the plate part 5 on the bow part 1_a. In this case too, the stabilizing surfaces formed by each displaced portion 7_a and the plate surface 12 are in engagement with the opposite sides, respectively, of the bow part 1_a, so that the parts are firmly held together.

Referring now to Figs. 4-5, the plate part 5_a does not have the displaced portions 7-7_a of the previous embodiments but is flat at opposite sides of the recess 6. At each side of this recess, the plate 5_a is provided with a hole 8_a for receiving a corresponding end portion of the bow part 1_b. The latter part, in this case, is not flat but is formed at each end portion with an upwardly and outwardly extending portion 13 which is displaced from but parallel to the plane of the main body of the bow part. The main body of the bow part 1_b is joined to each displaced portion 13 along its slanting lower and inner edge by a portion 14 which extends through the corresponding hole 8_a and on which the corresponding bearing surface 9_b of the plate part rests. The displaced portion 13 at each end portion of the bow part 1_b is adapted to be inserted through the corresponding hole 8_a in the plate part so as to support the latter by interengagement of the parts 9_b and 14. It will be understood that at each end portion of the bow part, the displaced portion 13 forms a stabilizing surface 12_a extending upwardly from the bearing surface 9_b and a stabilizing surface 11_a extending downwardly from this bearing surface, the two stabilizing surfaces engaging opposite sides, respectively, of the plate 5. Thus, these two parts are held securely against relative movement about the bearing surfaces 9_b.

In each of the embodiments described above, the bow part 1 should be designed to fit closely to the plate part 5 so that there is no play or vibration between these parts when they are pushed along the

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carrying bar 2.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a plate heat exchanger comprising a carrying bar, a plate part having in its upper edge an upwardly opening recess for receiving the bar, and a bow part resting intermediate its ends on the bar and on the opposite end portions of which the plate part is detachably mounted at opposite sides, respectively, of said recess, the improvement wherein the plate part has two holes at opposite sides of the recess, the plate part also having bearing surfaces located adjacent the upper edges of the respective
- 15 holes and resting, respectively, on said bow end portions, one of said plate and bow parts having a pair of stabilizing surfaces extending upwardly and downwardly, respectively, from each of the bearing surfaces, each pair of stabilizing surfaces of said one
- 20 part lying in generally parallel planes which are displaced from each other in a direction normal to the plane of the plate part, and each pair of stabilizing surfaces of said one part engaging the other part at opposite sides thereof respectively.
- 25 2. The improvement according to claim 1, in which said stabilizing surfaces are on the plate part.
3. The improvement according to claim 1, in which the plate part has portions displaced from the plane of the plate part but parallel to said plane, said
- 30 displaced portions forming said holes and also forming one of the stabilizing surfaces of each pair, each of said displaced portions forming with the main body of the plate part a slot which opens downwardly toward said recess, each slot being
- 35 adapted for introduction of the corresponding end of the bow part into the slot.
4. The improvement according to claim 1, in which the plate part has portions displaced from the plane of the plate part but parallel to said plane, said
- 40 displaced portions forming said holes and also forming one of the stabilizing surfaces of each pair, each of said displaced portions forming with the main body of the plate part a slot which opens downwardly and toward said recess, each slot being
- 45 adapted for introduction of the corresponding end of the bow part into the slot, each displaced portion having a horizontal upper edge joined to the main body of the plate part by a portion forming one of said bearing surfaces, each displaced portion also
- 50 having a vertical side edge joined to the main body of the plate part by a portion forming a step engageable with the corresponding end of the bow part.
5. The improvement according to claim 1, in
- 55 which said stabilizing surfaces are on the bow part.
6. The improvement according to claim 1, in which each end portion of the bow part has an upwardly extending portion displaced from but parallel to the plane of the bow part, each of said
- 60 displaced portions being joined to the main body of the bow by a portion extending through one of said holes and on which the corresponding bearing surface of the plate part rests, the main body of the bow part forming the downwardly extending stabilizing surfaces,
- 65 and said displaced portions of the bow forming the upwardly extending stabilizing surfaces.
7. The improvement according to claim 1, in which the plate part has a generally vertical surface
- 70 extending downwardly from each bearing surface and forming a stop engaging the corresponding end of the bow part, whereby the stops hold the plate part and the bow part against relative movement endwise of the bow part.